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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Preparing Activity: KSC

NASA/KSC-27 05 26.00 98 (October 2007)

Superseding
NASA/KSC-27 05 26.00 98 (April 2006)

NASA/KSC GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2009

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DIVISION 27 - COMMUNICATIONS

SECTION 27 05 26.00 98

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

10/07

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SECTION 27 05 26.00 98

GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS
10/07

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NOTE: This specification covers the requirements for electrical system and equipment grounding including ground rods, grounding conductors, connectors, and other accessories for small jobs. The section excludes instrumentation and static grounding systems.

Drawings must show plan layout of each grounding electrode, ground mat, ground grid, substation ground bus, interconnecting grounding conductor, and tap connections to steel building columns and outdoor electrical equipment. Detail drawings of ground mats and ground grids must show configuration, ground rod spacings, interconnecting cable and tap connections to substation yard fence, substation ground bus, and interior equipment.

If grounding systems as shown fail to achieve the desired measured resistance to ground, additional ground rods could be required.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet. a Criteria Change Request (CCR).

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PART 1 GENERAL

1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text are automatically deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 8	(2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

JOHN F. KENNEDY SPACE CENTER (KSC)

KSC-SPEC-Z-0005	(Am 2; 1975) Brazing, Steel, Copper, Aluminum, Nickel, and Magnesium Alloys
KSC-STD-E-0012	(Rev A; 1974; Am 1; 1978) Bonding and Grounding

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007; AMD 1 2008) National Electrical Code - 2008 Edition

U.S. AIR FORCE TECHNICAL ORDERS (TO)

TO 31W3-10-15	(1980; CHG 3 1982) Outside Plant Cable Testing

UNDERWRITERS LABORATORIES (UL)

UL 467	(2007) Standard for Grounding and Bonding Equipment

1.2 GENERAL REQUIREMENTS

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NOTE: If section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS are not included in the project specification, applicable requirements therefrom must be inserted and the following paragraph deleted.
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Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS apply to work specified in this section.

1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Keep submittals to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, use a code of up to three characters within the submittal tags following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.
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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Ground Rods
Ground and Bond Wires
Grounding and Bonding Connectors
Grounding and Bonding Fasteners

PART 2 PRODUCTS

2.1 GROUND AND BOND WIRES

Ground and bond wires must be in accordance with ASTM B 8 and must be annealed bare copper, Class "B" stranded, with 98 percent conductivity. Size of wires must be in accordance with the requirements of NFPA 70.

2.2 GROUNDING AND BONDING CONNECTORS

Grounding and bonding connectors must conform to the requirements of UL 467.

2.3 GROUNDING AND BONDING FASTENERS

All bolts, nuts, washers, lock washers, and associated fasteners used for grounding and bonding connections must be [copper] [bronze] [tin plated tempered brass].

2.4 GROUND RODS

Grounds must be 20 millimeter diameter by 6100 millimeter 3/4 inch by 20 feet copper clad steel rods in accordance with KSC-STD-E-0012.

PART 3 EXECUTION

3.1 GENERAL

Specify NFPA 70 bonding and grounding requirements as a minimum.

3.2 BONDING

3.2.1 Types of Bonds

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NOTE: Choose from one of the bond types or a combination of bond types listed below.
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Unless otherwise specified herein,accomplish bonding of metal surfaces by [brazing] [welding] [clamping] [structural joining methods] [a combination thereof].

3.2.1.1 Brazing

Brazing solder must conform to KSC-SPEC-Z-0005.

3.2.1.2 Welding

Welding must be by the exothermic process. Welding procedure must include the proper mold and powder charge and must conform to the manufacturer's recommendation.

3.2.1.3 Clamping

In external locations, use clamping only where a disconnect type of connection is required. Connection device can utilize either spring-loaded jaws or threaded fasteners. Device must be so constructed that positive contact pressure is maintained at all times. This method includes the use of machine bolts with tooth type or spring type lock washers.

3.2.2 Cleaning of Bonding Surfaces

All surfaces which comprise the bond must be thoroughly cleaned before joining to remove paint, oxides, and other resistance films from the mating surfaces. Use gentle and uniform pressure along with an appropriate abrasive to ensure a smooth, uniform surface without "point contacts." Excessive metal must not be removed from the surface. Clean clad metals with a fine steel wool or grit in such a manner that the cladding material is not penetrated by the cleaning process. Bare metal must then be cleaned with solvent-moistened cheesecloth. Grease, oil, dirt, corrosive preventatives, and other contaminants must also be removed using this same method. Allow this cleaned area to air dry before making bond. Attach bond within 1 hour after cleaning. Seal joint and refinish the exposed surfaces within 2 hours to prevent oxidation. If additional time is required, apply a corrosion-preventative compound until the area can be refinished.

3.2.3 Bond Resistance

Test resistance of any bond in accordance with TO 31W3-10-15. Rework bonds that fail to successfully comply to test parameters at no additional cost to the Government.

3.2.4 Enclosure Bonding

All new FOT cabinets must be bonded to ground. At least one copper connection must be made from the system ground point to one or more enclosures in the area such that all enclosures and equipment when properly bonded together provide a low impedance path to ground.

3.2.5 Cable Tray Bonding

Cable tray sections must be bonded together. Consider cable tray sections in tandem assembly as having electrical continuity when these sections are bonded with appropriate high strength bolts. Whenever expansion joints are required, install a jumper consisting of a bond strap. Trays must be grounded to the building ground system.

3.2.6 Bonding of Conduit and Raceway Systems

Metal conduit, fittings, junction boxes, outlet boxes, armored and metal sheathed cable, and other raceways must be bonded as listed below. Care must be taken to ensure adequate electrical contact at the joints and terminations.

3.2.7 Rigid Metal Conduit and Terminations

All threaded connections must be [cleaned and coated with conductive epoxy] [welded as specified herein] and be wrench tight. All exposed threads must be painted. Conduits entering boxes and enclosures must be [welded]

[conductive epoxy coated and bonded to the box with bonding type locknuts (one outside and one inside)] [locknut and grounding type bushing]. Locknuts that gouge into the metal box when tightened are acceptable.

3.2.8 Protection of Finished Bonds

Protect finished bonds by painting to match the original finish after bond is made.

3.2.9 Splice Bonds

Cable with over all shields must have the shield continuity maintained through each splice. Bond clamp must have perforating teeth to penetrate the cable's metallic shield and be connected across the splice with the equivalent of a 4.1 millimeter diameter (No. 6 AWG) No. 6 AWG copper conductor.

3.3 GROUNDING CONNECTIONS

All ground connections must be bonded connections in accordance with paragraph entitled, "Bonding."

Weld all ground connections that are buried or in inaccessible locations. The process must join all strands and must not in any way cause the parts to be damaged or weakened.

3.4 PLACING GROUND RODS

Install and test ground rods in accordance with KSC-STD-E-0012.

-- End of Section --